Research Paper | Computer Science | E-ISSN No : 2454-9916 | Volume : 2 | Issue : 4 | April 2016

IMPLEMENTATION ON PUBLIC KEY CRYPTOGRAPHY AND LOCATION BASED AUTHENTICATION FOR KERBEROS AUTHENTICATION PROTOCOL

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ABSTRACT

Kerberos is one of the advanced security system that helps prevent people from stealing information that gets sent across the network from one computer to another. Usually, these people are after your password. The Kerberos security system, guards electronic transmissions that get sent across the Internet. It does this by scrambling the information -- encrypting it -- so that only the computer that is supposed to receive the information can unscramble it, or say decrypt it. In addition, it makes sure that your password itself never gets sent across the wire: only a scrambled "key" to your password. To make a certain addition to the Kerberos Protocol we add the public key Cryptography for the phases of the Kerberos Authentication System. This would help in a more secure and a password attack free system. There would also be addition of the current location of the user requesting the service to the Data provided by the user which would add to more authentication and security.

KEYWORD: Authentication , Kerberos , public-key cryptography , PKINIT , PKCROSS, PKTAPP .

I. INTRODUCTION

Authentication is a fundamental building block for a secure network environment. In modern computer systems authentication provides service to multiple users and provides the ability to accuretly identify the user making a request. Today more common in computer network architecture is a distributed architecture consisting of dedicated user workstations and distributed or centralised servers in this environment. Thus we need to protect user information and resources housed at the server. This environment must provide means to ensure that the workstation can identify its users properly. A communication procedure runs between two or more cooperative principles in this environment is called a protocol. Authentication protocol is a series of steps and message exchanges between multiple entities in order to achieve authentication objective. These protocols are usually a combination of cryptographic techniques and other means. Some of the authentication protocols use symmetric cryptography techniques. In the authentication protocols that use symmetric cryptography techniques both the encryption and the decryption process need the same key, so the communication entities need to share a secret key. Authentication based on public key cryptography has an advanrage over many other authentication schemes because no secret information has to be shared by the entities involved in the exchange. A user attempting to authenticate oneself must use a private key to digitally sign a random number challenge issued by the verifying entity. If the verifier can successfully verify the signed response using the user's public key, then the user has been successfully authenticated.

II. NEED FOR KERBEROS PROTOCOL

The World Wide Web provides a way that the users access the services over the internet remotely and in such cases the data that the user provides is confidential enough to be known by any of the third parties. There has to be secure authentication mechanism to only let the authorized users access the data remotely. The simplest way how authentication works is to verify whether the user proves who he claims to be. Consider one of the following scenarios.

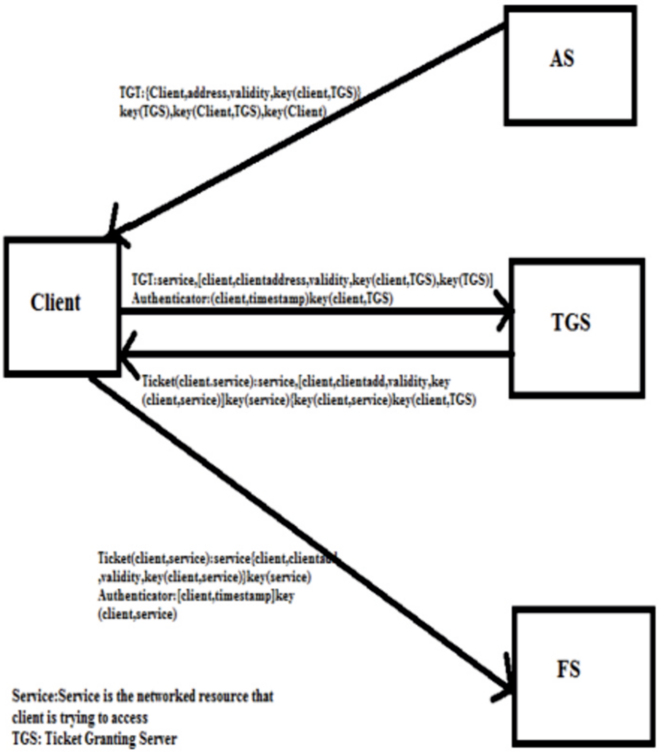
- A user gaining access to a particular workstation and pretending to be another user operating from that workstation.

- A user altering the network address of a workstation so that the requests sent from the altered workstation appear to come from the impersonated workstation.

- A user can eavesdrop on exchanges and use a reply attack to gain entrance to a server or to disrupt operations.

In any of these cases, an unauthorized user may be able to gain access to services and data that he or she is not authorized to access. Rather than building in elaborate authentication protocols at each server, Kerberos provides a centralized authentication server whose function is to authenticate users to servers and servers to users. Unlike most other authentication schemes, Kerberos relies exclusively on symmetric encryption, making no use of public -key encryption. But the secret key encryption provides the benefit at the cost of the passwords, hence the security ends once the password is cracked. Hence we plan the replacement of secret key with the public key cryptography in the first phase.

1. BASIC KERBEROS WORKING


AS
TGT:{Client,address,validity,key(client,TGS)}
key(TGS),key(Client,TGS),key(Client)
Client
TGT:service,[client,clientaddress,validity,key(client,TGS),key(TGS)]
Authenticator:(client,timestamp)key(client,TGS)
TGS
Ticket(client.service):service,[client,clientadd,validity,key
(client,service)]key(service){key(client,service)key(client,TGS)
Ticket(client,service):service{client,clientadd
,validity,key(client,service)}key(service)
Authenticator:[client,timestamp]key
(client,service)
FS
Service:Service is the networked resource that
client is trying to access
TGS: Ticket Granting Server

The entire Kerberos process has 8 steps.

1. The authentication service, or AS, receives the request by the client and verifies that the client is indeed the computer it claims to be. This is usually just a simple database lookup of the user's ID.

2. Upon verification, a timestamp is created. This puts the current time in a user session, along with an expiration date. The default expiration date of a timestamp is 8 hours. The encryption key is then created. The timestamp ensures that when 8 hours is up, the encryption key is useless. (This is used to make sure a hacker doesn't intercept the data, and try to crack the key. Almost all keys are able to be cracked, but it will take a lot longer than 8 hours to do so.)

3. The key is sent back to the client in the form of a ticket-granting ticket, or TGT. This is a simple ticket that is issued by the authentication service. It is used for authenticating the client for future reference.

4. The client submits the ticket-granting ticket to the ticket-granting server, or TGS, to get authenticated.

5. The TGS creates an encrypted key with a timestamp, and grants the client a service ticket.

6. The client decrypts the ticket, tells the TGS it has done so, and then sends its own encrypted key to the service.

7. The service decrypts the key, and makes sure the timestamp is still valid. If it is, the service contacts the keydistribution centre to receive a session that is returned to the client.

8. The client decrypts the ticket. If the keys are still valid, communication is initiated between client and server.

III. PUBLIC KEY EXTENSION PROTOTYPES.

In three different ways we can actually insert the public key in the basic Kerberos system.

A. PKINIT Prototype

Public key cryptography can be used to secure the initial authentication procedure. The purpose of this procedure is for the Kerberos server to transmit credentials(TGT and Session Key)to the client user who requested it.In PKINIT the, public key cryptography is used for two functions

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1. Verifying the clients digital signature contained in AS_REQ,so that to avoid request from masquerading intruders.

2. Encrypting the TGT and session key in the server response,so that an eavesdropper cannot obtain the user's credentials.

PKINIT modifies the AS exchange but Not other part of basic Kerberos Protocol.

B. PKCROSS Prototype

The public key extension proposed in PKCROSS take place only between pairs of key distribution centres. This kind of communication will be transparent to end users requesting cross-realm tickets.The PKCROSS ticket is used to achieve mutual authentication between the local KDC and the remote KDC.The messages exchanged between the two KDCs closely follow the PKINIT specification, with the local KDC acting as thclient.When the remote KDC issues a PKCROSS ticket to the local KDC can in sequence issue a remote realm TGT to its local client on behalf of the remote KDC.

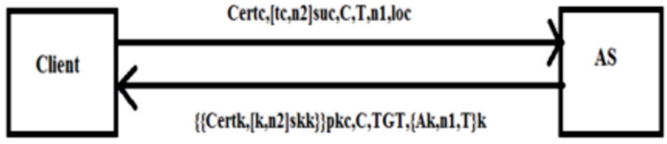
C. PKTAPP Prototype

In traditional Kerberos system , the KDC issues all TGS, remote KDC and server tickets in its realm. Thus, most authentication transaction should transit the KDC. Therefore it can become a performance bottleneck. Although secondary KDCs can be included in the system,their typical use is just as backups in the event of primary KDC failure. The aim of PKTAPP specification is to eliminate this potential bottleneck and reduce this communication traffic by enabling the authentication exchange to be directly performed between the client and the application server.

IV. KERBEROS WITH PKINIT

The Public key addition in the first phase of the Kerberos authentication process would definitely add up to the security level of the protocol. Already the some of the implementers of Kerberos have added this security level.

PKINIT describes how Public Key Cryptography can be added to Kerberos in the Initial Authentication stages. Already Microsoft, Cyber safe and Heimdal have adopted it in their implementations of Kerberos. PKINIT requires the verification of the initial request message sent by the client to the local KDC (Authentication Server). Any authentication requests made by intruders masquerading as legitimate users will be denied. PKINIT also requires that the Ticket granting Ticket and the session key be encrypted so that the user's credentials will also remain confidential.


Certc,[tc,n2]suc,C,T,n1,loc
Client
AS
{{Certk,[k,n2]skk}}pkc,C,TGT,{Ak,n1,T}k

This diagram shows the basic message for first phase of the Kerberos process using public key. The Client's name, the name of TGS and the nonce part of the message is same as in Kerberos version 5. The Certificate is added by the PKINIT, This is the client's certificate and there is also a timestamp and nonce encrypted over a secret key.

The second phase shows the formalization of response. The last part of the message "C, TGT, {AK, n1, tK, T}k"is very similar to reply in basic Kerberos, the difference is that the symmetric key k protecting AK is now generated by AS and not a long-term shared key. The TGT and the message encrypted under k are as in traditional Kerberos. Because k is freshly generated for the reply, it must be informed to C before C can learn AK. PKINIT does this by adding the boxed message {{CertK, [k, n2]skK}}pkC. This contains K's certificates and its signature, using its secret key skK, over k and the nonce n2 from C's request; all of this is encrypted under C's public key pkC

V. LOCATION BASED

We shall also add the location based authentication to our Kerberos authentication system for its advantages. Consider the example of a multinational company that gives a separate email id and database access to the employees. Now every employee would get a employee email id specific to the company. This id he can access in the company premises as well as any other area outside the company. But when you take the case of the database access you certainly don't want it to be accessed outside the company, it should only be dealt with in the premises. So location based authentication would help here. Consider an employee of that company wanting to access the company database at his home, the location based authenticator would deny him the permissions of any such access. It would work on the longitudes and latitudes and anything outside its limit would result in denial of that service. Now of course that location based addition should not affect the email access of the employee anywhere in the world. We shall also add the administrator rights so that the location based service can be enabled and disabled appropriately.

VI. FUTURE SCOPE AND CONCLUSION

The Kerberos Authentication protocol has been used by many companies as a trusted authentication protocol. There are a lot of advantages of the protocol like a mutual authentication between the clients and the server. The passwords are never sent across the network. The addition of public key and location based would certainly add up the authentication and security level. Unlike many alternative authentication mechanisms, Kerberos is entirely based on open Internet standards. A number of well-tested and widely-understood reference implementations are available free of charge to the Internet community. Commercial implementations based on the accepted standards are also available.

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